



# Blood Pressure 101

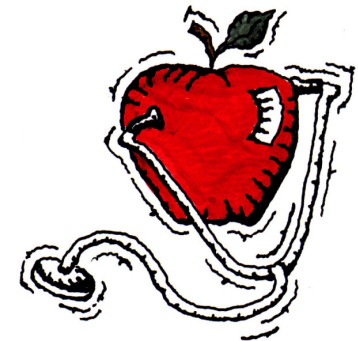
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# Blood Pressure - What is it?

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- ❑ Blood pressure is the pressure inside your blood vessels generated by your heartbeats but also affected by your body's flexible blood vessels.
  - Think about the pressure of water in your house
    - ❑ Too high– pipes bursting in your house from pressure being too high
    - ❑ Too Low- trying to take a shower no water pressure

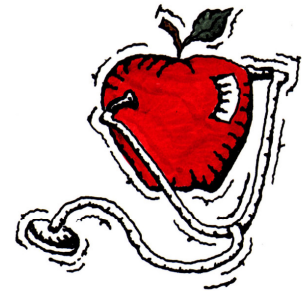


# Blood Pressure - What is it?

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How is it measured?

Two numbers:



Top number - Systolic  
Bottom Number - Diastolic (down)

Systolic - highest pressure of the heart beat

Diastolic – lowest pressure when heart is relaxing

Please write down the equation on the next slide as it is important to remember.

# Blood Pressure - What is it?

## Relation to wall tension [\[edit\]](#)

Regardless of site, blood pressure is related to the [wall tension](#) of the vessel according to the [Young–Laplace equation](#) (assuming that the thickness of the vessel wall is very small as compared to the diameter of the [lumen](#)):

$$\sigma_{\theta} = \frac{Pr}{t}$$

where

- $P$  is the blood pressure
- $t$  is the wall thickness
- $r$  is the inside radius of the cylinder.
- $\sigma_{\theta}$  is the [cylinder stress](#) or "hoop stress".

For the thin-walled assumption to be valid the vessel must have a wall thickness of no more than about one-tenth (often cited as one twentieth) of its radius.

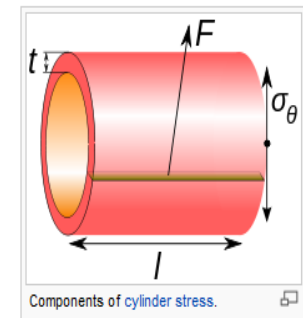
The [cylinder stress](#), in turn, is the average [force](#) exerted circumferentially (perpendicular both to the axis and to the radius of the object) in the cylinder wall, and can be described as:

$$\sigma_{\theta} = \frac{F}{tl}$$

where:

- $F$  is the [force](#) exerted circumferentially on an area of the cylinder wall that has the following two lengths: sides
- $t$  is the radial thickness of the cylinder
- $l$  is the axial length of the cylinder

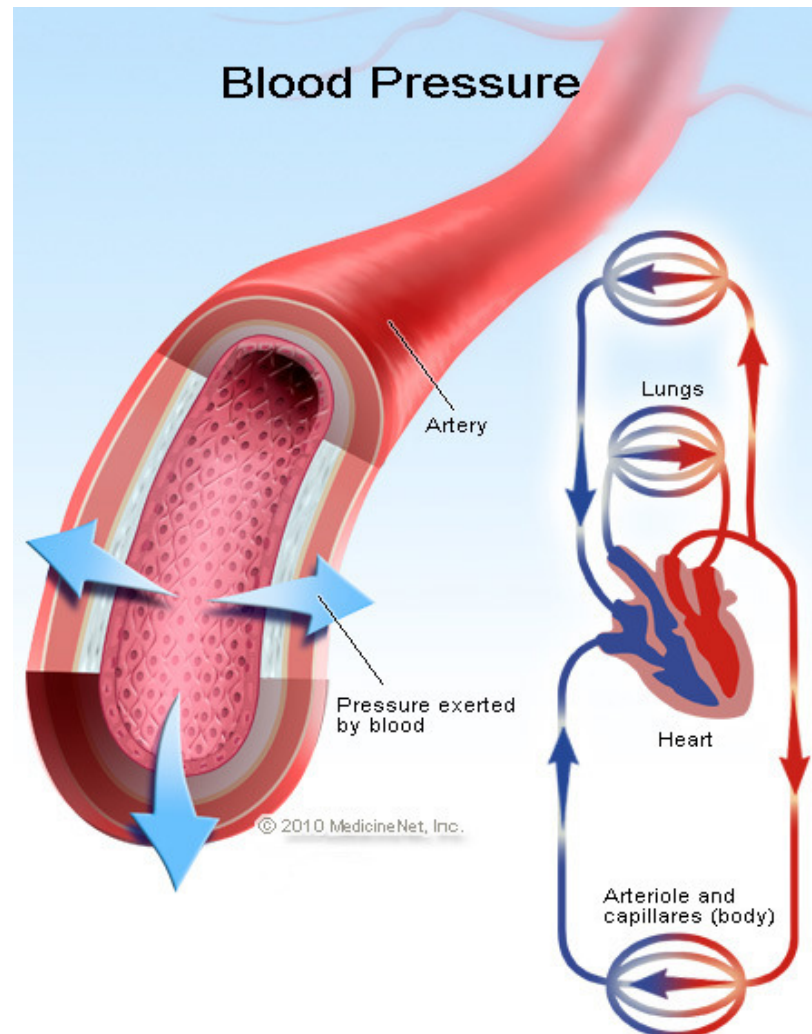
# Just Kidding!



## References [\[edit\]](#)

1. <sup>a</sup> "Normal Blood Pressure Range Adults" [↗](#). Health and Life.
2. <sup>a</sup> <sup>b</sup> Caro, Colin G. (1978). *The Mechanics of The Circulation*. Oxford [Oxfordshire]: Oxford University Press. ISBN 0-19-263323-6.
3. <sup>a</sup> Klabunde, Richard (2005). *Cardiovascular Physiology Concepts*. Lippincott Williams & Wilkins. pp. 93–4. ISBN 978-0-7817-5030-1.
4. <sup>a</sup> <sup>b</sup> "Understanding blood pressure readings" [↗](#). American Heart Association. 11 January 2011. Retrieved 30 March 2011.
5. <sup>a</sup> <sup>b</sup> "Low blood pressure (hypotension) — Causes" [↗](#). MayoClinic.com. Mayo Foundation for Medical Education and Research. 2009-05-23. Retrieved 2010-10-19.
6. <sup>a</sup> <sup>b</sup> Chobanian AV, Bakris GL, Black HR et al. (December 2003). "Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure" [↗](#). *Hypertension* 42 (6): 1206–52. doi:10.1161/01.HYP.0000107251.49515.c2 [↗](#). PMID 14656957 [↗](#).
7. <sup>a</sup> <sup>b</sup> "Diseases and conditions index – hypotension" [↗](#). National Heart Lung and Blood Institute. September 2008. Retrieved 2008-09-16.
8. <sup>a</sup> NHS choices: What is blood pressure? [↗](#) Retrieved 2012-03-27

# Blood Pressure Illustrated



# Blood Pressure Readings

Blood Pressure Category	Systolic mm Hg (upper #)		Diastolic mm Hg (lower #)
Normal	less than 120	and	less than 80
Prehypertension	120 – 139	or	80 – 89
High Blood Pressure (Hypertension) Stage 1	140 – 159	or	90 – 99
High Blood Pressure (Hypertension) Stage 2	160 or higher	or	100 or higher
<u>Hypertensive Crisis</u> (Emergency care needed)	Higher than 180	or	Higher than 110

# What are the Signs/Symptoms of High Blood Pressure?

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- ❑ Usually NO symptoms!
  - Called **"The Silent Killer" or "Sleeping Giant"**
- ❑ With extremely high blood pressure may have:
  - Headache
  - Dizzy spells
  - Blurry vision
  - Nosebleeds
  - Chest pain
  - Frequent urination at night

# Statistics

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- ❑ In the United States 1 in 3 adults have high blood pressure!!
  - ❑ 67 million people
- ❑ More than half of the adults with high blood pressure do not have it under control!!
  - ❑ 36 million people
  - Many with uncontrolled Blood pressure don't even know they have it!!
    - ❑ 14 million people
- ❑ Millions of people are taking blood pressure medications but they are still not under control.
- ❑ Numerous missed opportunities to measure and act on high blood pressure- this is a true Public Health Issue. Doctors, nurses, health care systems and the public need to take action

# Why is Uncontrolled Hypertension Dangerous?

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## Health Effect Pointers

- Contributes to nearly 1000 deaths /day
- 4 times likely to die from a stroke
- 3 times likely to die from heart disease
- Shortened life span
- If blood pressure is persistently 50% more than average a person is not expected to live more than a few years unless treated

## Conditions Caused by Uncontrolled High Blood Pressure

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- ❑ Stroke (most people don't die from stroke but have significant Morbidity)
- ❑ Heart Attacks (major Contributor)
- ❑ Heart Failure (Congestive Heart Failure)
- ❑ Arterial Aneurysms
- ❑ Leading Cause of Kidney Failure and need for dialysis

# Risk Factors That Can NOT Be Controlled

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- ❑ Heredity
  - Parents or other close blood relatives
- ❑ Race
  - African Americans more likely to have high BP at an earlier age
- ❑ Increasing Age
  - Early middle age – more common in men
  - Women more likely to develop after menopause
- ❑ Certain Medical Conditions
  - Kidney abnormalities, rare tumors, adrenal gland abnormalities, narrowing of certain arteries

# Controllable Risk Factors

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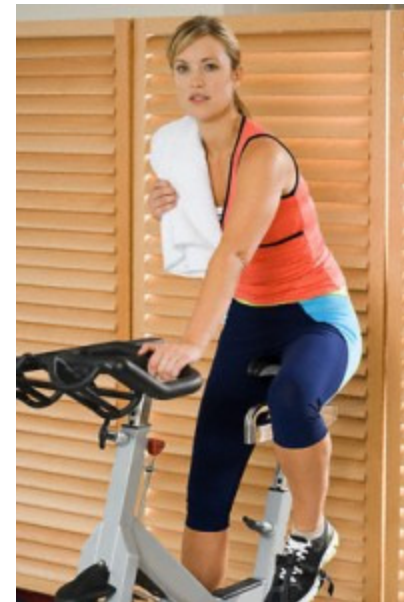
- ❑ Sedentary or inactive lifestyle
- ❑ Heavy and regular alcohol consumption
- ❑ Tobacco use
- ❑ Too much sodium/too little potassium in the diet
- ❑ Obesity and overweight
- ❑ Stress
- ❑ Lack of Sleep



# Considerations for Women

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- ❑ Oral Contraceptives
- ❑ Pregnancy
- ❑ Menopause and HRT



# Warning: Over-the-Counter Medications

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- ❑ Always read labels on all OTC medications, especially if blood pressure is  $>120/80$  mm HG – look for warnings & check with doctor
- ❑ Decongestants – many OTC cold and flu preparations contain this – may raise blood pressure or interfere with effectiveness of some prescribed bp meds
- ❑ Check sodium content – some OTCs are high – look at active and inactive ingredients lists – “sodium” or “soda”

# 10 Ways to Control Your High Blood Pressure

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- ❑ Have it checked regularly & know your numbers-consider self monitoring
- ❑ Keep your weight within normal parameters
- ❑ Do not use salt in cooking or at meals; avoid salty and processed foods
- ❑ Eat a diet rich in fruits, vegetables and whole grain high fiber foods
- ❑ Control alcohol intake; no more than one drink a day for women and two a day for men

# 10 Ways to Control – Continued

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- ❑ Take your medications as prescribed, don't miss doses
  - Check with your provider to make sure you are getting enough calcium, vitamin D and potassium
  - Certain medications may cause high blood pressure
- ❑ Keep appointments with your health care provider
- ❑ Physical activity – at least 30 minutes of moderate to vigorous physical activity most days
- ❑ Stop smoking
- ❑ Manage stress in your life

# To Shake or Not to Shake?

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- ❑ Kosher salt and most sea salt are chemically the same as table salt (40% sodium) – they count the same toward total sodium consumption
- ❑ Table salt is NOT the primary source of sodium in American diets – 75% of sodium consumed by Americans found in processed foods such as tomato sauce, soups, condiments, canned foods and prepared mixes



# How to Lower Your Salt Intake?

- ❑ Consume less than 2,300 mg salt per day (approximately 1 teaspoon), if have hypertension **less than 1,500 mg per day**
- ❑ Eat more fresh fruits and vegetables
- ❑ Read food labels – especially canned and processed foods
- ❑ Select unsalted nuts or seeds, dried beans, lentils, etc.



# Lower Salt Intake – Continued

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- ❑ Do not use salt during cooking – try a salt free seasoning or use spices & herbs to enhance the taste of food
- ❑ Do not salt food before you taste it
- ❑ Eat less salted chips, lunchmeat and hot dogs, dill pickles and many canned foods
- ❑ Select unsalted, fat free broths or soups
- ❑ When dining out, request your dish be prepared without salt
- ❑ Utilize the DASH (Dietary Approaches to Stop Hypertension) eating plan

# Did you know?

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- ❑ Mc D's Quarter Pounder with Cheese

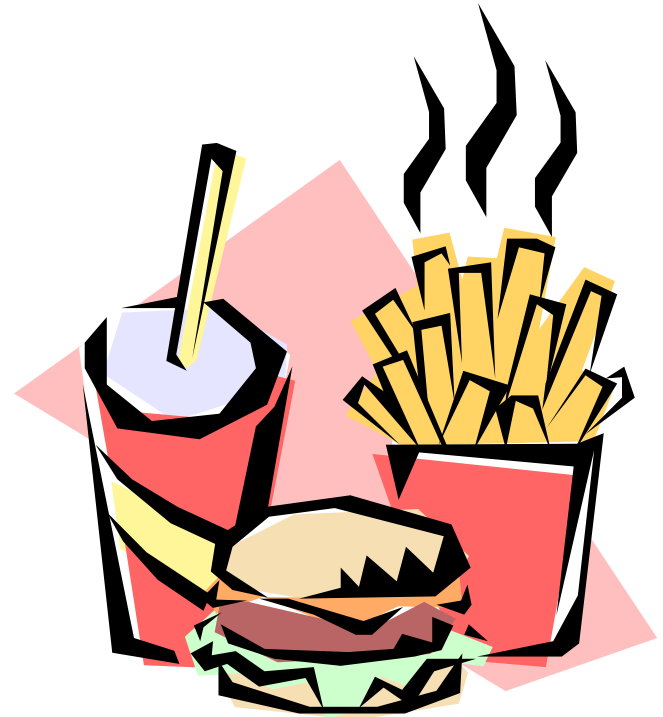
- Calories: 510
- Fat: 26 g
- Sodium: 1,190 mg

- ❑ Large Coke 310 Calories

- ❑ French Fries Large

- Calories: 500
- Fat: 25 g
- Sodium: 350 mg

Total Sodium: 1,540 mg



# Did you know?

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## ❑ Olive Garden's Grilled Chicken Caesar Salad

- Calories: 850
- Fat: 64 g
- Sodium: 1,880 mg



## ❑ Panera's New England Clam Chowder (8 oz)

- Calories: 320
- Fat: 28 g
- Sodium: 740 mg



# Did you know?

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- ❑ Taco Bell's Grilled Stuffed Burrito – Beef
  - Calories: 680
  - Fat: 30 g
  - Sodium: 2,120 mg
- ❑ Taco Bell's Fiesta Taco Salad
  - Calories: 840
  - Fat: 45 g
  - Sodium: 1,780 mg

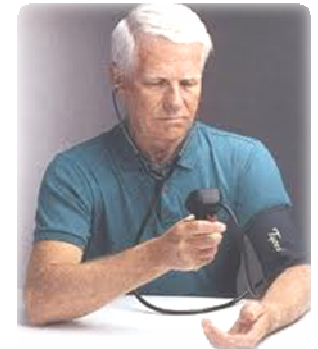


# Measuring Blood Pressure

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## Equipment

- Oscillatory - Automated electronic- arm, wrist – usually utilize oscillations for measurements
- Auscultatory – use of the stethoscope to listen to the pulse



## Measuring

- Simple and once learned its like “Riding a bike”
- Electronics are easy with little if no training but need recalibration and may be affected by heart conditions irregular heart beats or “stiff vessels”

# Measuring Using the Stethoscope

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1. Inflate cuff around arm until the reading is about 10 mmHg above the patients usual blood pressure
2. Place stethoscope over inside part of arm at the elbow
3. Deflate cuff slowly at about 5 mmHg/sec and listen for the first sound –Systolic Reading
4. Continue to deflate at same rate until pulse disappears – Diastolic Reading



# How did we get this way?

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**Courtesy of Kathy Sherman**

Remember...it is about lifestyle changes!!

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**Courtesy of Dr. Richard Lafleur**

# Resources to Help with Your Health

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- ❑ State of NH Wellness Program Website
  - [www.nh.gov](http://www.nh.gov)
- ❑ Anthem
  - [www.anthem.com](http://www.anthem.com)
  - Healthy Lifestyles
- ❑ WebMD
  - [www.webmd.com](http://www.webmd.com)
- ❑ NH Department Health & Human Services
  - [www.dhhs.nh.gov](http://www.dhhs.nh.gov)

# References

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- ❑ American Heart Association
- ❑ MedicineNet.com
- ❑ Harvard Health
- ❑ Mypyramid.gov
- ❑ National Heart, Lung and Blood Institute
- ❑ Richard Lafleur, MD, FACP,  
Medical Director, Anthem BC & BS, NH